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THE NURSE AND HER RELATION TO IMMUNOLOGY ANTIGENS AND ANTIBODIES

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Even a cursory glance at the history of the development of medicine will disclose a constant tendency toward measures aimed at the prevention of disease. Even in the primitive days when diseases were looked upon as manifestations of the disapproval or anger of the gods, or as resulting from the machinations of demons and evil spirits, we find, in the early writings, much prominence given to directions for propitiating and appeasing the various influences held responsible, with the idea of warding off the diseases thought to result from their evil influence.

With the discovery of bacteria and protozoa and the gradual evolution of an understanding of the mechanism whereby they produce pathological effects, the efforts to counteract and prevent their activities became more systematized and intelligent so that the present century finds preventive medicine securely placed upon a sound and scientific footing and ever advancing in its warfare for the eradication of disease.

The history of nursing, likewise, shows a constant trend in the same direction, the more marked because it has taken place in a relatively short time. It is not so very many years since the days of Sairey Gamp whose attention was focussed less upon the patient than upon the brown bottle on the mantelpiece; or from the days of Florence Nightingale, the first to realize that nursing involved, not only the care of the sick, but the prevention of the further ills which might befall them, to the nurse of today whose greatest endeavors are directed not only to care of the sick but to the safeguarding of the well,—in a word, preventive medicine.

It is not enough, however, to rely upon the education of doctors and nurses alone. A most potent weapon in the fight against disease lies in the education of the public, and it is in this connection that the nurse stands in a most important and strategic position arising from her close and intimate relation to the public whom she serves, for often a clear and simple explanation from her, an intelligent answer to the question of some "doubting Thomas" will be of more value than a host of public lectures or articles in popular magazines which often fail to reach those for whom they are most intended.

It is evident, therefore, that if the nurse is to act as a medium

for the dissemination of information to the public, she must be well grounded in the subject which she is to teach and it is the purpose of this paper to consider from this standpoint the practical relations of the problems of immunology to the prevention of disease.

The use of serums and vaccines has become so common as to cease to arouse much interest and to be looked upon as a matter-of-fact procedure by the nurse, surrounded and harassed by a multitude of duties, and her curriculum is, as a rule, so crowded as to leave neither room nor time for a consideration of the principles upon which their use is based,—and yet, if she were able to express those principles in simple language there would, oftentimes, be a heavy mortality in the ranks of the various “antis” and of those who object to the use of serum “because it is such a strain on the heart.”

The principles of immunity may be briefly expressed. Immunity may be looked upon as a term expressing the power of an individual to resist disease, or, if amplified, to resist the effects of micro-organisms or their products which are pathogenic for other individuals of the same species.

It had long been known as a matter of common observation that individuals who had suffered from an attack of certain diseases seldom, if ever, again contracted the same disease; and, moreover, that certain individuals under the same circumstances of exposure, apparently were not susceptible to the disease at all. Two things were obvious: in the first instance, something must have been produced in the body of those recovering from these diseases whereby they were thereafter protected; and in the second instance, something of a protective nature must have been present in the bodies of those who were not susceptible.

To find out what these substances were, how they were produced, and whether or not they could be produced at will and transferred from one to another, were the objects of studies culminating in our present knowledge and application of the principles of immunity in the prevention and treatment of disease in general.

Two terms at once appear and reappear in the literature of the subject which it is necessary to understand: antigen and antibody.

If, as a result of the introduction of an infective agent into the body, something is produced which will protect the body against further onslaughts, then the infective agent must in some way, have generated against itself, some antagonistic body,—whence come the terms antigen and antibody.

An antigen, then, is any substance which, when introduced into the body, will give rise to the production of substances capable of acting against it, or antibodies.

An antibody is a specific substance produced by the cells of the host in reaction against an antigen.

Among the substances so derived are:

1. Antitoxins: specific substances capable of neutralizing specific toxins, the term specific denoting the fact that a particular antitoxin will combine with and neutralize only the toxin which caused its production.
2. Agglutinins: specific substances capable of causing agglutination or clumping of the agent (antigen) causing their production.
3. Precipitins: specific substances capable of causing precipitation from solution of the substances causing their production.
4. Opsonins: specific substances capable of so acting upon bacteria as to render them more susceptible to destruction by leukocytes (phagocytosis).
5. Lysins: specific substances capable of causing lysis or solution of their antigens.

Numerous theories have been advanced to explain the intricate mechanism involved in the complex process resulting in the production of these substances of which the most prominent and, all in all, the most satisfactory is the Side-chain Theory of Ehrlich.

Originally evolved to explain the nutritive processes of the cell, the theory has been adapted and enlarged to cover what is thought to be the mechanism concerned with antibody formation. It must be emphasized that the entire theory is hypothetical.

Ehrlich visualizes the cell as possessing two executive centers, as it were: one presiding over the function of the cell as, in a gland cell, to secrete; and one which controls and superintends the processes of nutrition, waste, and repair. It is with the latter that we are particularly concerned.

If the cell is to live it must be nourished; to be nourished it must be able to grasp, absorb, and utilize food molecules in its vicinity. It is easy to visualize, in a purely diagrammatic way, this ability by imagining various outgrowths from the cell capable of combining with certain food elements,—these outgrowths being called, by Ehrlich, side-chains.

The picture thus obtained is analogous to and, indeed, derived from the graphic method of presenting chemical formulae. For example, instead of representing the ability of one atom of oxygen to combine with two atoms of hydrogen to form water by the formula H_2O , we may indicate it by the graphic formula $O \begin{smallmatrix} \text{H} \\ | \\ \text{H} \end{smallmatrix}$ in which the combining ability of the oxygen (O) is represented by two receptors or side-chains to each of which is attached an atom of hydrogen (H).

In similar fashion we can imagine the combining ability of the cell to be represented by projecting side-chains or receptors each specific and adapted only to a certain substance. Among these would be side-chains for union with a toxin, for example.

However, as a result of the union of toxin and receptor the latter is destroyed, injuring the cell in this respect.

Here we leave Ehrlich, temporarily, and turn our attention to the investigations of Weigert. As a result of his studies on the mechanism of repair after injury, Weigert noted the prodigality of nature in its reaction to injury. He found that, in cells having the ability to repair damage done to them, the reaction was always in excess of the damage. In other words, if one cell only had been destroyed, the body replaced it by an excessive reproduction of cells of that type, and this fact is embodied in what is known as Weigert's Law of Overproduction in Repair.

Applying this law to the formation of antibodies we find that one toxin receptor having been destroyed, the cell, in its efforts to replace the receptor, produces not one, but a large number of similar receptors. There is only place for the attachment of one to the cell,—what becomes of the others? They remain free in the blood stream. Each has the same structure as the original; each has, therefore, the power of combining with a toxin molecule and thereby preventing it from acting directly on the cell and causing injury; and each is, therefore, a free antibody, in this case a free antitoxin.

This, in brief, is the nucleus of the side-chain theory of Ehrlich upon which our present explanation of the mechanism of immunity depends.

A consideration of the practical applications of immunology in the treatment and prevention of disease will be discussed in a later paper.

THE ALUMNAE ASSOCIATIONS: THEIR POWER AND THEIR RESPONSIBILITIES AS AFFECT- ING THE SCHOOLS, THE GRADUATES, AND THE COMMUNITY¹

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This subject is one of the most vital that the nursing profession faces, the alumnae associations forming, as it were, the backbone of its organizations. At various times, doubt has been expressed as to the wisdom of the reorganization of the American Nurses' Association, for some have feared that the alumnae association would lose its prestige and thereby its importance be lessened to the new graduates.

¹ Read at the annual meeting of the New York State Nurses' Association, Albany, October, 1920.